Appendix 8:

Alliant Energy Technical Guidelines for Interconnection of Parallel-Operated Generation Connected to the Distributed System

Technical Guidelines for Interconnection of Parallel-Operated Generation Connected to the Distribution System

Revised July 26, 2002

1.0 PURPOSE

The purpose of this guideline is to outline the minimum requirements for safe and effective interconnection of customer-owned generator less than 10 MW connected in parallel with the Alliant Energy distribution system. The distribution system is defined as the Alliant Energy system that operates at a nominal voltage of less than 34 kV. Alliant Energy and the customer shall be guided by this document when planning the inter-tie between facilities owned by Alliant Energy and the customer. The information contained in this guide is not intended to capture all specific equipment and installation requirements, and emphasis must be placed on the fact that these guidelines are minimal and may require modification for a particular installation.

Should the customer decide to isolate their generation and not provide the capability to parallel their generation with Alliant Energy, the customer does not need approval by Alliant Energy. In this instance there shall be no means, either deliberate or accidental, by which parallel operation may be achieved. A normally open switch is not an acceptable isolation device between the customer generation and the Alliant Energy system. The customer is required to have a licensed electrician complete the installation of any transfer equipment to meet Article 230 of the National Electrical Code.

2.0 INTERCONNECTION POLICY

2.1 It is Alliant Energy's policy to permit a customer to operate generating equipment in parallel with the Alliant Energy system, providing it can be done safely. Alliant Energy requires that certain protective devices, as outlined in this document, shall be installed at the Point of Common Coupling where a customer desires to operate their system in parallel with Alliant Energy. The purpose of these devices is to separate parallel-operated, customer-owned generation from the Alliant Energy electric system during abnormal operating conditions. This is done to protect the general public and Alliant Energy personnel from injury, and to prevent damage to Alliant Energy and customer-owned electrical equipment.

2.2 Single-phase and three-phase customer-owned generation may be connected in parallel with Alliant Energy providing these facilities meet the requirements outlined in this guideline. The Alliant Energy approval process shall be followed when customers are interested in paralleling with the Alliant Energy system. Employees of Alliant Energy shall report findings of any unapproved parallel operation to the Alliant Energy System Protection Department. An Alliant Energy management team will then review the facilities and take any necessary action to assure safe operation. Alliant Energy will reserve the right to open the inter-tie to any customer who violates any of these operating guidelines.

2.3 Alliant Energy shall not assume any responsibility for the protection of customer's generation or any other customer owned equipment. The customer shall be completely responsible for protecting their system from any abnormalities, including those created by the operation of the Alliant Energy system.

3.0 GENERAL OPERATING REQUIREMENTS

3.1 Prior to establishing service for parallel operation, the customer shall obtain approvals from Alliant Energy for facility requirements and operating procedures for the customer's parallel generation. The customer is responsible for specifying appropriate equipment so that the parallel generation is compatible with the Alliant Energy electric delivery system. The customer, in satisfying the requirements, is also responsible for meeting any applicable federal, state and local codes, including but not limited to the National Electric Code and the National Electric Safety Code.

3.2 The specific Alliant Energy operating requirements for all customers with parallel generation include the following:

3.2.1 Voltage Range

The customer shall operate their generator(s) to maintain the same voltage level as the Alliant Energy system at the point of common coupling. The customer must provide an automatic method of disconnecting their generator(s) from the Alliant Energy system if the voltage cannot be maintained within Alliant Energy limits as stated in Table 3.1.

3.2.2 Voltage Fluctuations

The operation of customer-owned Distributed Generation systems is not allowed to produce excessive flicker to adjacent customers, therefore, the customer shall not cause voltage fluctuations (flicker) in excess of 2% on the distribution system at the point of common coupling.

3.2.3 Frequency

All customer generation shall operate at 60-hertz. The customer shall provide and automatic disconnecting means from the Alliant Energy system when generation falls outside the values prescribed in Table 3.1.

Table 3.1: Voltage/Frequency Disturbance Delay & Trip Times

Range		**Trip Time**	
Percentage	**Voltage[1]**	**Seconds**	**Cycles**
<50%	<60	0.166	10
50%-90%	60-108	2.0	120
90%-110%	108-132	Normal Operating Range	
110%-120%	132-144	1.0	60
>120%	>144	0.1	6
	Frequency (Hz)		
	Units ≤30kW		
	<59.3	0.166	10
	59.3-60.5	Normal Operating Range	
	>60.5	0.166	10
	Frequency (Hz)		
	Units >30kW		
	<57	0.166	10
	57-59.3	1.0	60
	59.3-60.5	Normal Operating Range	
	>60.5	0.166	10

[1] Voltage based on 120V, nominal.

3.2.4 Harmonics

The customer's generating equipment shall not introduce excessive distortion to the Alliant Energy sinusoidal voltage or current waveforms. Guideline values for total harmonic distortion shall be at or below values published in the latest issue

of ANSI/IEEE 519, "Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems." If the generation produces unacceptable harmonics during parallel operation, per IEEE Standard 519, it shall be required to be removed and locked-out from service until the problem is resolved.

3.2.5 System Protection

The customer is responsible for providing adequate protection for Alliant Energy facilities for conditions that arise during parallel-operated generation. The customer is also responsible for providing adequate protection to their facility under any Alliant Energy operating condition whether or not the parallel generation is in operation. Conditions may include but are not limited to:

- single phasing of supply,
- system faults,
- equipment failures,
- abnormal voltage or frequency,
- lightning and switching surges,
- excessive harmonic voltages,
- excessive negative sequence voltages,
- separation from Alliant Energy supply (islanding).

The customer shall cooperate with Alliant Energy in the analysis of disturbances to either the customer's facility or Alliant Energy's electric system by gathering and providing access to any information relating to a disturbance, including information from oscillographs, protective relay targets and reports, breaker operations, power quality monitors and sequence of events recorders.

3.2.6 Power Factor

The customer shall maintain a power factor range of 95% lagging to 95% leading, measured at the point of common coupling. Failure of the customer to maintain a power factor within this range may result in rate penalties to the customer and/or discontinuation of the parallel operation with the customer's generation. In some cases, the power factor requirement may be much closer to unity as negotiated in the interconnection agreement.

3.2.7 Synchronizing

The customer shall be solely responsible for synchronizing their generator(s) with the Alliant Energy system. Alliant Energy will have the right to review, approve and inspect the method of synchronization. Automatic synchronizing settings will not be changed following installation unless mutually agreed to by both parties. The customer must install proper sensing devices to sense a de-energized circuit to assure that a de-energized circuit of Alliant Energy is not energized.

3.2.8 Islanding

Under certain conditions with extended parallel operation, it would be possible for a part of the electrical power system to be disconnected from the rest of the utility grid and have the Generation System continue to operate and provide power to a portion of the electrical power system. This condition is called "islanding". It is not possible to successfully reconnect the isolated circuit to the rest of the Alliant Energy system since there are no synchronizing controls associated with all of the possible locations of disconnection. Therefore, it is a requirement that the

Distributed Generation be automatically disconnected from the system immediately by protective relays for any condition that would cause the system to be de-energized. The Generation System must then either isolate with the customer's load and/or be blocked from closing back into the electrical power system until the electrical power system is energized for several minutes from the normal utility source. Depending upon the size of the Distributed Generation and the electrical power system loads, it may be necessary to install direct transfer trip equipment from the Alliant Energy source to remotely trip the generation system to prevent islanding.

3.2.9 Reclosing

Alliant Energy provides automatic reclosing to transmission and distribution circuits. Upon request, these reclosing times for the Alliant Energy source breaker(s) will be given to the customer. It is the customer's responsibility to design and maintain their system to properly isolate parallel generation upon loss of the Alliant Energy supply before any reclosing operation.

3.2.10 Interrupting Device

To properly isolate parallel generation from the Alliant Energy system, customers with three-phase generation shall provide a three-phase interrupting device with appropriate protective relays. Customers with single-phase generation shall provide at least a single-phase interrupting device with appropriate protective relays and/or other protective equipment. These devices shall also be capable of interrupting the maximum available fault current at that location. Three-phase devices shall interrupt all three phases simultaneously, and shall have a separate tripping control independent of the AC source, i.e., a DC battery and charger. This requirement may be waved for generation with a line-commutated inverter.

The interrupting device shall be located within the customer's facility in accordance with applicable codes. If specific site issues require that the interrupting device be located within an Alliant Energy facility, any wiring, installation, testing and maintenance of this device shall be accomplished by Alliant Energy personnel at the customer's expense.

3.2.11 Grounding

Grounding shall be of sufficient size to handle the maximum available ground fault current and shall be designed and installed to limit step and touch potentials to safe levels as set forth in "IEEE Guide for Safety in AC Substation Grounding", ANSI/IEEE Standard 80.

All electrical equipment shall be grounded in accordance with local, state and federal electrical and safety codes and applicable standards.

3.2.12 Transformer

Alliant Energy may require, at the customer's expense, a dedicated transformer or transformers to serve the customer's generation. Since transformer connections and configuration can significantly impact Alliant Energy electric system operation, Alliant Energy shall review and approve the configuration of any customer-owned interconnection transformer(s). This includes, but is not limited to, transformer connection configuration (delta, wye) and grounding method (solid ground, ungrounded, impedance grounded…). It is the customer's

responsibility to receive written approval from Alliant Energy prior to purchasing any interconnection transformer(s).

3.2.13 Disconnection Means

The customer shall provide a disconnecting device for use by Alliant Energy as a means of electrically isolating the Alliant Energy system from the generation system and to establish working clearances for maintenance and repair work in accordance with Alliant Energy safety rules. This disconnecting device may be located at the point of common coupling between the customer and Alliant Energy's electric power system, or it may be located between the generation system and the customer's load. Depending on system configuration and application, Alliant Energy may require that the disconnecting device have load break capability.

The disconnecting device shall be physically located for ease of access by Alliant Energy personnel. Access shall be available at all times for Alliant Energy personnel. The type of disconnecting device must allow for visual indication of the contact's position. A molded-case type circuit breaker alone is not sufficient, as it does not allow visual indication of contact position. The disconnecting device's operating handle shall be lockable only in the open position with a standard Alliant Energy padlock. All devices and their locations are subject to approval by Alliant Energy.

Alliant Energy reserves the right to open the disconnecting device and lock it in the open position. Conditions in which this may occur include but are not limited to:

- Alliant Energy personnel and/or public safety is threatened,
- repair or maintenance of Alliant Energy facilities,
- inspection of customer's generating and protective equipment reveals a hazardous situation,
- lack of customer maintenance or maintenance records,
- generation interferes with other Alliant Energy customers and/or the Alliant Energy electric system as outlined in these guidelines.

3.2.14 Communications

The customer shall employ qualified operators for the generating facility and for coordinating operations of the generation facility with Alliant Energy. The customer shall provide Alliant Energy with contact numbers for the generating facility, with at least one contact number designated as available 24 hours a day. The customer shall notify Alliant Energy of any operational constraint, including production schedule estimates (as applicable).

3.2.15 Routine Maintenance and Emergency Repairs

Alliant Energy performs routine maintenance and inspections of its distribution, substation and transmission facilities. The coordination of the maintenance of these facilities takes into account numerous factors, including but not limited to the capability to serve load, safety, customer requirements and economics. Alliant Energy will use reasonable efforts to schedule planned inspection and maintenance to mutually agreed to times that are designated to have minimal disruption on the operation of the generating facility.

Alliant Energy performs most routine maintenance during normal working hours. The customer may request that this maintenance occur outside of normal working hours or meet an expedited schedule. The customer agrees to reimburse Alliant Energy for any incremental costs for meeting special schedule requirements.

Under Emergency conditions the output of the customer-owned generation facility shall be adjusted to a safe operating level, including shutdown. Alliant Energy will take all prudent measures to return the electric delivery system to a normal operating state. Alliant Energy will not reimburse the customer for any costs associated with an unexpected shutdown during Emergency conditions.

4.0 PROTECTION REQUIREMENTS

Alliant Energy requires adequate interconnection protection to separate customer-owned generation from the Alliant Energy electric system. The purpose of this equipment is to detect customer energization of an Alliant Energy circuit that has been de-energized, detect the customer's generation operating at an abnormal voltage or frequency, or detect a fault or abnormal condition on the Alliant Energy electric system that requires separation of the customer's parallel generation facilities.

The customer shall provide all required interconnection protective equipment. This equipment shall be approved by Alliant Energy and provide the protective functions specified within this guide. This equipment shall be located within the customer's facility. If specific site issues require the equipment to be located within an Alliant Energy facility, any wiring, installation, testing and maintenance of this equipment shall be accomplished by Alliant Energy personnel at the customer's expense.

Note that the protection of the interconnection between Alliant Energy and the customer is given in this guideline -- it is the responsibility of the customer to provide protection for their own equipment. These protection schemes are only guidelines; final requirements will be established during the engineering process.

4.1 Requirements for Photovoltaic, Fuel Cell, Microturbine and other inverter-based systems (less than 100 kVA)

Adequate interconnection protection is typically provided as an integral part of these generation systems. Customers shall confirm that the power inverter used is classified as a non-islanding inverter conforming to IEEE P929 (Recommended Practice for Utility Interface of Photovoltaic Systems), and UL 1741 (Standard for Static Inverters and Charge Controllers for Use in Photovoltaic Power Systems).

4.2 Requirements for Single Phase Induction Generators (less than 20 kVA)

These relatively small generators operated in parallel with the Alliant Energy electric delivery system usually require adding fairly simple protection schemes. When a fault occurs on the Alliant Energy system, Alliant Energy will isolate the faulted line from the system fairly quickly. Because of the large imbalance between the load and generation, the voltage and frequency relays at the generator will detect the fault and isolate the generation.

The specific protective relay requirements for this class of generator are shown on drawing A1.1 in Appendix 1.

4.3 Requirements for Small, Three Phase Generators (less than 200 kVA)

Small three phase generators can supply greater amounts of energy to a fault on the Alliant Energy system; therefore, additional protection is required.

The specific protective relay requirements for this class of generator are shown on drawing number A1.2 in Appendix 1.

4.4 Requirements for Large, Three Phase Generators (200 kVA or larger)

Large generators can deliver a significant amount of energy to a fault on the Alliant Energy electric delivery system. The level of protection for this class of generation is greater in order to provide high-speed separation of the generation during system disturbances.

Output contacts of relays installed on these generators shall directly energize the trip coil of the customer's breaker or an intermediate auxiliary tripping relay that directly energizes the breaker trip coil. The relaying system shall have a reliable source of power independent from the AC system (DC battery and charger) to assure proper operation of the protection scheme. The protective relays shall be utility grade devices as defined in ANSI/IEEE Standard C37.90, "Relays and Relay Systems Associated with Electric Power Apparatus."

All relays shall have appropriate test switches (ABB type FT-1 preferred) to allow testing the operation of the relay without unwiring or disassembling the relay. Relay settings shall be reviewed and approved by the Alliant Energy System Protection Department. The relays shall be grouped in dedicated panels or cabinets accessible to Alliant Energy personnel.

Voltage transformers installed on the primary side of the step-down transformer connected phase to ground are required for some of the protective functions. A primary fused cutout and secondary fused safety switch are required to prevent accidental backfeed from wound-potential transformers. Current transformers shall have shorting terminal blocks as necessary for metering and relaying.

Alliant Energy may require a communications channel be installed as part of the relay protection scheme for this class of generation. This communications channel may be a leased telephone circuit, power line carrier, Alliant Energy owned pilot wire, microwave, or other means determined by Alliant Energy. This communication circuit and associated communication equipment, at the both the customer and Alliant Energy facilities, shall be installed at the customer's expense.

This class of customer owned generation may be interconnected with the Alliant Energy electric system using various transformer connections. The required protective functions are dependent on the type interconnection transformer connection utilized for a particular installation.

The specific protective relay requirements for this class of generator are shown on drawing numbers A1.3 through A1.6 in Appendix 1.

COMMISSIONING, TESTING AND MAINTENANCE REQUIREMENTS

When the customer's equipment has been installed and functionally tested by the customer, Alliant Energy shall witness final operational tests of the interconnection relay system. These tests will consist of verifying the relays have the correct voltages and currents, as well as function in the manner intended. Alliant Energy shall not be responsible for verifying any control or signal wiring not directly related to the interconnection relay. The customer is responsible for all relay settings, testing and calculations needed for protection of their equipment.

Alliant Energy reserves the right to verify on demand the calibration of all protective equipment including relays, interrupting devices, etc., at point of common coupling. Verification may include the tripping of the inter-tie interrupting device by the protective relays. After proper operation of the equipment is demonstrated, Alliant Energy may request that a protective seal be placed on relaying equipment to prevent unauthorized tampering.

For installations where the relays and inter-tie interrupting device(s) are not installed within an Alliant Energy facility, the customer shall be responsible for maintenance and testing of this equipment. The customer shall not exceed Alliant Energy recommended maintenance intervals. Provisions shall be made for Alliant Energy to have access to this equipment for inspection, testing and control. Maintenance documentation and test reports shall be furnished to Alliant Energy.

For installations where the relays and inter-tie interrupting device(s) are installed within an Alliant Energy facility, Alliant Energy shall maintain this equipment and bill the customer for maintenance cost. Alliant Energy has the option of using its own personnel or contracting this maintenance work to others.

The customer has sole responsibility for the routine maintenance of their generating and protective equipment. The customer is encouraged to contact the Alliant Energy System Protection Department for recommendations for maintenance practices and testing intervals of their protective equipment. Complete maintenance records shall be maintained by the customer and be made available upon request for Alliant Energy review. Failure of the customer to provide proper routine maintenance may result in the customer being required to cease parallel operation.

6.0 METERING AND TELEMETERING REQUIREMENTS

The Customer shall agree to allow Alliant Energy to install on their premises the equipment necessary to measure loads or any part thereof, to measure the energy produced, to collect and obtain any other data necessary to determine operating characteristics of such installation served under the particular service classification. Metering to be installed according to applicable tariff and/or contract.

Alliant Energy shall furnish electric meters, test switches, and instrument transformers including secondary wiring. The customer shall furnish meter sockets, associated cabinets and enclosures for meter equipment, and all conduits and piping between the instrument transformers and meter sockets and provide a suitable metering mounting location. The customer shall be responsible for the cost of the installation and the associated costs of the metering equipment.

A four-quadrant electricity meter is required at each generation facility regardless of the generation size. The meter shall be configured to separately register “in” Kwh (Rkvah) and “out” Kwh (Rkvah). The meter will record each quadrant of energy in separate registers and data channels and located at the point of common coupling. Additional metering may be required for verification of standby capacity and operating reliability when typical auxiliary power is less than 10% of the CT primary rating sized for the generation or if Alliant Energy deems it necessary to accurately meter the auxiliary power separately in order to calculate net generation and accurately meter auxiliary power load when the generator is out of service.

For regulatory purposes, an additional meter is required at the specific generator terminals to monitor the kWh "out" supplied by the generator. The meter must be in a location accessible to Alliant Energy employees at any time. It is acceptable to use customer owned instrument transformers. The customer shall be required to pay a monthly metering charge. The meter will be owned by Alliant Energy and shall be tested in accordance with local applicable testing rules.

Alliant Energy shall require the continuous telemetry of power quantities for all aggregate generation over one (1) megawatt to the Alliant Energy Distribution Dispatch Center (DDC) and the Generation Management System (GMS). The Alliant Energy System Operations Center (SOC) will require continuous telemetry for aggregate generation quantities over five (5) megawatts. The specific telemetry requirements are shown in Appendix 2. The customer shall furnish and install, at their expense, the necessary communication channel(s) (typically a dedicated circuit) and the necessary Alliant Energy approved telemetering equipment and devices. For net generation in excess of 5 MWs, the customer shall furnish and install, at their expense, an additional telephone circuit for data collection purposes. Alliant Energy and the customer together can determine if this telephone circuit can be shared for another purpose.

Instrument transformers

a. Current and voltage transformers used for revenue metering shall meet or exceed an accuracy class of 0.3%.
b. When sizing current transformers, the rating factor should be considered to optimize light load or reverse load situations.
c. When metering resides at distribution voltage, higher accuracy CTs, such as the General Electric "Accu-bute" TM should be used.
d. Connected burdens shall not exceed the burden rating of any transformer.
e. Instrument transformer secondaries shall be limited to the electricity meters and transducers providing data for operational purposes, if applicable. Test switches shall be installed to allow independent testing an/or maintenance so as to not interrupt the operation of the other devise utilizing the secondary circuits of the instrument transformers.
f. Where revenue metering instrument transformers shall reside inside customer owned primary switchgear, on a case-by-case basis, the switchgear manufacturer may install the company owned instrument transformers at their factory.
g. Instrument transformers will normally be located at the overhead-to-underground primary service drop and will be of the 15KV class for 12.4 KV or 13.08 KV distribution systems.

Net generation meters and gross generation meters used for revenue

a. Meters shall be form 9, 3 element, for 4 wire systems and form 5, 2 element, for 3 wire systems. The meter shall be socket type.
b. Meters shall meet or exceed the latest version of American National Standard Institute (ANSI) C12.20 (Electricity Meters 0.2 and 0.5 accuracy class).
c. Meters shall be solid-state type capable to record delivered and received KWH (Rkvah) separately.
d. Meters shall have individual registers, recorder data channels, and outputs, if applicable, for each measured value.
e. Meters shall be required to calculate and record for transformer losses if the metering is located on the low side of the transformer and the point of ownership change is on the high side of the transformer.
f. Meters shall be equipped with recorder under glass with mass memory of at least 35 days of storage for the total number of data channels required. Where net generation exceeds 5 MWs, meters shall be equipped with internal modem.
g. For net generation of 5 MW and greater, the meter shall be equipped with a form "C" pulse output for input into an Alliant Energy RTU. An isolation rely is not required when the meter and RTU are on the same ground plane.
h. For net generation of 5 MW and greater, an analog option board may be installed in the meter in place of installing transducers, if applicable.
i. Unless mutually agreed upon, all meters shall be tested on a schedule that meets or exceeds the periodic test intervals per local state requirements.

Auxiliary meters

a. Meters shall be form 9, 3 element, for 4 wire systems and form 5, 2 element, for 3 wire systems. The meter shall be socket type.
b. Meters shall meet or exceed the latest version of American National Standard Institute (ANSI) C12.20 (Electricity Meters 0.2 and 0.5 accuracy class).
c. Meters shall measure KWH and be equipped with recorder under glass with at least 35 days of storage.
d. For generation at exceeds 5 MW, meters shall be equipped with an internal modem and connected to the telephone system.
e. Meters shall be tested on the same interval as the generation meter.

COSTS INCURRED

The Customer shall agree to install, operate and maintain their parallel generation facilities without cost to Alliant Energy. It shall also be the Customer's responsibility to install, operate and maintain this system safely.

The Customer shall be responsible for any costs required to upgrade the Alliant Energy electric delivery system to provide parallel operation. This may include, but is not limited to, upgrade of transformer insulation levels, installation of upgraded lightning arresters, distribution line upgrade, and/or the replacement of circuit breakers due to increased fault current levels. It shall also include all engineering costs associated with equipment additions and/or replacements. Any equipment to be installed on Alliant Energy property shall be accomplished by Alliant Energy personnel at the customer's expense. The specific details of these costs will be explained in the Interconnection Agreement.

8.0 DESIGN REVIEW PROCESS

An Application and Approval Process shall guide the customer and Alliant Energy employees. This process includes the submittal of an Application (see Appendix 3) and a project one-line drawing of the proposed installation. This information shall be furnished in sufficient detail to allow Alliant Energy to review the project requirements. This submittal will also include the customer's proposed interconnection relay system. The customer will also pay a $280 non-refundable fee for each Application submitted to Alliant Energy. The customer may be required to pay additional study fees, depending on the complexity of the installation. Alliant Energy will inform the customer of any additional fees prior to starting any additional studies.

The customer should begin their detailed design only after Alliant Energy review of the initial application and one-line drawing. Alliant Energy will commit to an installation time frame only after sufficient design information has been furnished to assure the agreed upon requirements are being met. The customer must consider the time constraints of Alliant Energy when scheduling the project. The customer shall allow a reasonable amount of time (typically six to eighteen months) after acceptance of the one-line and relay system design for any modifications to Alliant Energy facilities. Significant modifications may require longer lead times.

All Applications for Parallel Operation with Alliant Energy are to be directed to the appropriate Account Manager. The Account Manager will act as the project manager and be responsible for following an Application and Approval Process.

After the project is determined to be feasible, a joint meeting may be held between the customer and Alliant Energy to discuss the financial aspects of the installation. A separate meeting may take place to organize the stages of installation. Should the customer, at any time, determine that the project is not feasible after submitting their application, the customer shall verify cancellation of the application in writing.

9.0 GLOSSARY

Alternating Current (AC): That form of electric current that alternates or changes in magnitude and polarity (direction) in what is normally a regular pattern for a given time period called frequency.

Ampere (Amp): The unit of current flow of electricity. It is to electricity as the number of gallons per minute is to the flow of water. One ampere flow of current is equal to one coulomb per second flow.

Automatic: Self-acting, operated by its own mechanism when actuated by some impersonal influence as, for example, a change in current strength; not manual; without personal intervention.

Automatic Reclosing: A circuit breaker has automatic reclosing when means are provided for closing without manual intervention after it has tripped under abnormal conditions.

Automatic Tripping (Automatic Opening; Automatic Disconnecting): The opening of a circuit breaker under predetermined conditions without the intervention of an operator.

Circuit: A conducting path through which an electric current is intended to flow.

Circuit Breaker: A device for interrupting a circuit between separable contacts under normal or fault conditions.

Closed Transition Transfer: In this scheme, a customer's source of power is transferred from Xcel Energy to its own generation and vice-versa while momentarily connecting the two systems together. Here, the Customer's load is not interrupted at all during the transfer process. The time duration of the momentary parallel (connection) of the two systems together is only long enough to safely start and bring the Customer's generation into synchronization or to safely shut down the generation. The parallel is typically completed within 30 seconds.

Current: A flow of electric charge measured in amperes.

Current Transformer (CT): A transformer intended for metering, protective or control purposes, which is designed to have its primary winding connected in series with a circuit carrying the current to be measured or controlled. A current transformer normally steps down current values to safer levels. A CT secondary circuit must never be open circuited while energized.

Delta Connected Circuit: A three phase circuit with three source windings connected in a closed delta (triangle). A closed delta is a connection in which each winding terminal is connected to the end (terminal) of another winding.

Demand: The rate at which electric power is delivered to or by a system; normally expressed in kilowatts, megawatts, or kilovolt-amperes.

Direct Current (DC): An electric current flowing in one direction only and substantially constant in value.

Disconnect: A device used to isolate a piece of equipment. A disconnect may be gang operated (all poles switched simultaneously) or individually operated.

Dispatchable: Capable of having generator output (real and reactive power) adjusted ("dispatched") upon request of Alliant Energy power system operator. The adjustment includes capability to start-up and shut down generating units.

Distributed Generation: Electrical generation facilities of 10 MW of capacity or less connected to a utility through a Point of Common Coupling**.**

Distributed Resources: Sources of electric power that are not directly connected to the bulk power transmission system. Distributed Resources includes both generators and energy storage technologies.

Electric Power System: Equipment and apparatus owned by Alliant Energy, including overhead and underground facilities, service entrance equipment, meters, transformers, etc., which make up the central station energy delivery system.

Emergency: A condition or situation that in the reasonable good faith determination of the affected party based on Good Utility Practice contributes to an existing or imminent physical threat of danger to life or a significant threat to health, property or the environment.

Energy Losses: The general term applied to energy lost in the operation of an electrical system. Losses can be classified as Transformation Losses, Transmission Line Losses or System Losses.

Frequency: The number of cycles occurring in a given interval of time (usually one second) in an electric current. Frequency is commonly expressed in hertz.

Fuse: A short piece of conducting material of low melting point, which is inserted in a circuit for the purpose of opening the circuit when the current reaches a certain value.

Generator: Any device producing electrical energy, i.e., rotating generators driven by wind, steam turbines, internal combustion engines, hydraulic turbines, solar, etc.; or any other electric producing device, including energy storage technologies.

Generation System: The interconnected Distributed Generator(s), controls, relays, switches, breakers, transformers and associated wiring and cables.

Good Utility Practice: Any of the practices, methods and acts engaged in or approved by a significant portion of the electric utility industry during the relevant time period, or any of the practices, methods and acts which, in the exercise of reasonable judgment in light of the facts known at the time the decision was made, could have been expected to accomplish the desired result at a reasonable cost consistent with good business practices, reliability, safety and expedition. Good Utility Practice is not intended to be limited to the optimum practice, method, or act to the exclusion of all others, but rather to be acceptable practices, methods, or acts generally accepted in the region.

Ground: A term used in electrical work in referring to the earth as a conductor or as the zero of potential. For safety purposes, circuits are grounded while any work is being done on or near a circuit or piece of equipment in the circuit; this is usually called protective or safety grounding.

Hertz (Hz): The term denoting frequency, equivalent to cycles per second.

Interrupting Capacity: The amount of current a switch, fuse, or circuit breaker can safely interrupt.

Interruption: A temporary discontinuance of the supply of electric power.

Island: A part of an interconnected system may be isolated during a system disturbance and start operating as a subsystem with its own generation, transmission and distribution capability. Then the subsystem becomes an island of the main interconnected system without a tie. In such a case, the islanded system and the main interconnected system will operate at different frequencies and voltages**.**

Kilovolt (kV): One thousand volts.

Kilovolt-Ampere (kVA): One thousand volt amperes. See the definition for Apparent Power.

Kilowatt (kW): An electric unit of power that equals 1,000 watts.

Kilowatthour (kWh): One thousand watts of power supplied for one hour. A basic unit of electric energy equal to the use of 1 kilowatt for a period of one hour.

Lagging Power Factor: Occurs when reactive power flows in the same direction as real power.

Leading Power Factor: Occurs when reactive power flows in the opposite direction of real power.

Line Losses: Electrical energy converted to heat in the resistance of all transmission and/or distribution lines and other electrical equipment.

Long Term Parallel Operation: During normal operation of the generator, the generator stays electrically interconnected with the Alliant Energy system.

One-Line Diagram: A diagram in which several conductors are represented by a single line and in which various devices or pieces of equipment are denoted by simplified symbols. The purpose of such a diagram is to present an electrical circuit or circuits in a simple way so that their function can be readily grasped.

Open Transition Transfer: In this scheme, a customer’s source of power is transferred from Source 1 to Source 2 and vice-versa without momentarily connecting the two sources together. Here, the Customer’s load is interrupted momentarily during the transfer process through a mechanical or electrical interlock.

Parallel Operation: The operation of a customer-owned generator while connected to the Alliant Energy electric power system. Parallel operation may be required solely for the Customer's operating convenience or for the purpose of delivering power to Alliant Energy.

Peak Load: The maximum electric load consumed or produced in a stated period of time.

Peak Shaving: Generator operation that results in reducing customer's peak load or demand. Closed-transition peak shaving is the condition where the generator is in a parallel operation with Alliant Energy's system. Open-transition peak shaving is the condition where the generator is **not** connected in parallel with the Alliant Energy System.

Point of Metering: The point where metering equipment (meters, transducers, current transformers, potential transformers, etc.) is or will be installed to measure the power flow and energy exchange between Alliant Energy and the Customer.

Power: Actual, Active or Real Power. The time rate of transferring or transforming energy or the power that accomplishes work. Measured in Watts.

Power Factor: The ratio of actual power (kW) to apparent power (kVA).

Power Flow: One-way power flow is the condition where the flow of power is entirely into the Customer's facility. Two-way power flow is the condition where the net flow of power may be either into or out of the Customer's facility depending on the operation of the generator and other customer load.

Point of Common Coupling: The point where the Generation System is connected to the Alliant Energy Electrical Power System.

Protection: All of the relays and other equipment that are used to open the necessary circuit breakers to clear lines or equipment when trouble develops.

QF: Qualifying Facility. An Independent Power Producer (IPP) that has met criteria to be certified by FERC as a Qualifying Facility and that has rights established by the PURPA of 1978.

Reactive Power: (VAR) The power that oscillates back and forth between inductive and capacitive circuit elements without ever being used. The function of reactive power is to establish and sustain the electric and magnetic fields required to perform useful work.

Received Energy: Energy received by Alliant Energy from the Customer.

Reclose: To return a circuit breaker to its closed position after it has opened by relay action.

Relay: A device that is operative by a variation in the condition of one electric circuit to affect the operation of another device in the same or in another electric circuit.

Self-Excited: An electric machine in which the field current is secured from its own armature current.

Self-Service Generators: Generators operated in parallel with the Alliant Energy System only for the purpose of reducing the Customer’s peak load. These generators are not normally dispatchable by Alliant Energy.

Separately Excited: Use of an exciter for sending current through the field windings of an electric machine in place of taking the field current from its own armature current.

Switch: A device for making, breaking or changing the connections in an electric circuit.

Synchronism: Expresses the condition across an open circuit wherein the voltage sine wave on one side matches the voltage sine wave on the other side in frequency and amplitude without phase angle difference.

Transformer: An electric device, without continuously moving parts, in which electromagnetic induction transforms electric energy from one or more other circuits at the same frequency, usually with changes of value of voltage and current.

Utility Grade Relays: Relays that meet IEEE standards C37.90, C37.90.1, and C37.90.2.

Voltage: Electric potential or potential difference expressed in volts.

Volt-Ampere: A unit of apparent power in an alternating-current circuit.

VAR: Volt ampere reactive, see Reactive Power.

Watt-Hour: A unit of work or energy equivalent to the power of one watt operating for one hour.

Wye or "Y" Connected Circuit (Star Connected): A three-phase circuit in which windings of all three phases have one common connection.

Appendix 1

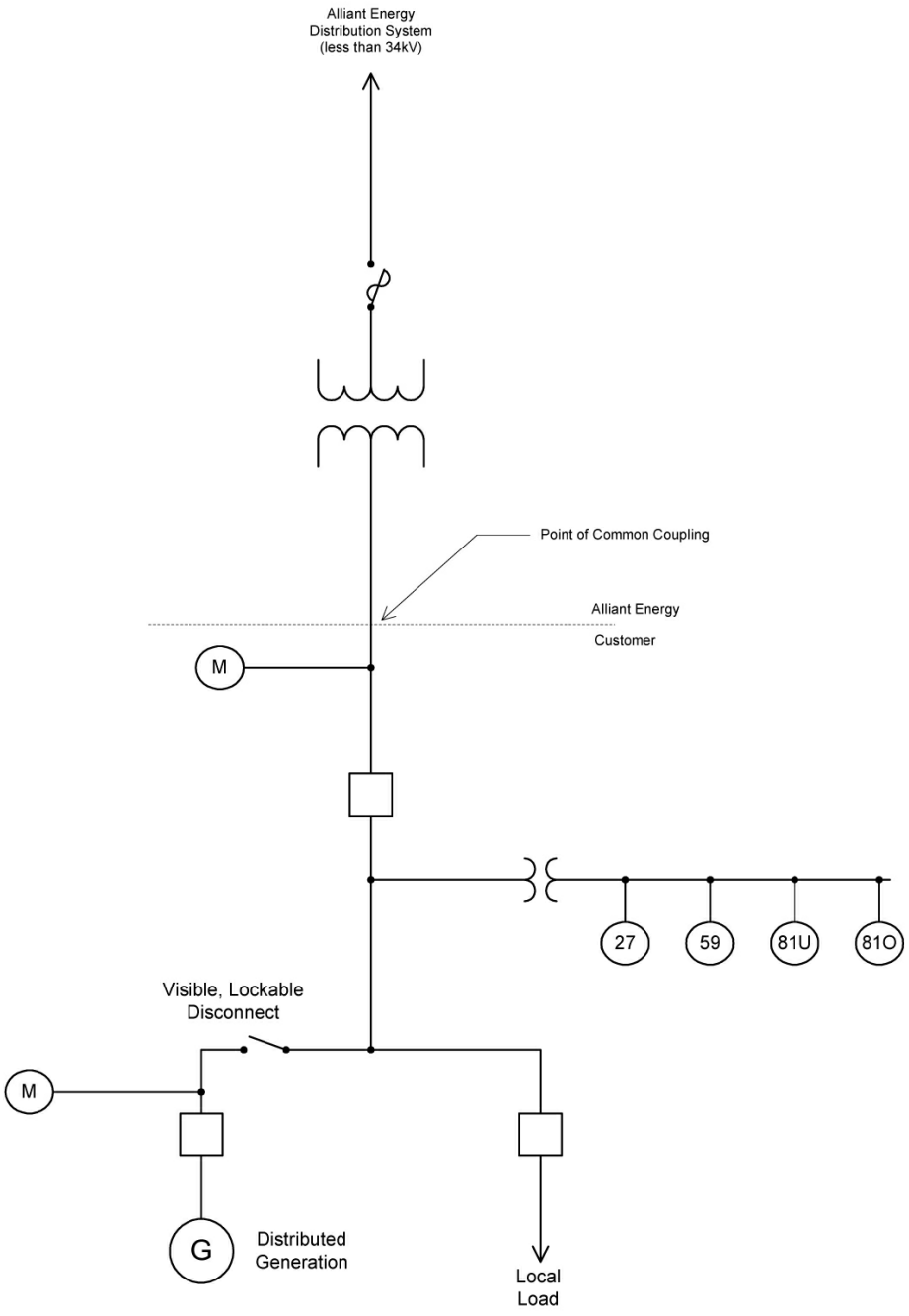
General Guidelines for

Protection Specifications

And One-Line Diagrams

	Distribution Transformer: A transformer used to change the voltage from a distribution voltage level (2400V-34kV) to a level for use by the customer (typically 277/480V, 120/208V, or 120/240V).
	Fuse: A short piece of conducting material of low melting point, which is inserted in a circuit for the purpose of opening the circuit when the current reaches a certain value.
	Disconnect: A device used to isolate a piece of equipment. A disconnect may be gang operated (all poles switched simultaneously) or individually operated.
	Circuit Breaker: A device for interrupting a circuit between separable contacts under normal or fault conditions.
	Potential Transformer (CT): A transformer intended for metering, protective or control purposes, which is designed to change the voltage from a distribution or utilization voltage level to a level for metering or protection purposes (typically 24V or 48V).
	Current Transformer (CT): A transformer intended for metering, protective or control purposes, which is designed to have its primary winding connected in series with a circuit carrying the current to be measured or controlled. A current transformer normally steps down current values to safer levels. A CT secondary circuit must never be open circuited while energized.
	Relay: A device that is operative by a variation in the condition of one electric circuit to affect the operation of another device in the same or in another electric circuit. The number corresponds to a specific relay type. The relay types are shown in the Table on page 6 of this Appendix 1.
	Meter: A device used to measure the flow of electricity (in kWh) between Alliant Energy and the customer. The meter may measure flow in one or both directions.
	Generator: Any device producing electrical energy, i.e., rotating generators driven by wind, steam turbines, internal combustion engines, hydraulic turbines, solar, etc.; or any other electric producing device, including energy storage technologies.
	Ground: A term used in electrical work in referring to the earth as a conductor or as the zero of potential. For safety purposes, circuits are grounded while any work is being done on or near a circuit or piece of equipment in the circuit; this is usually called protective or safety grounding.

ALLIANT ENERGY	**Symbols List for One-Line Diagrams**	Revised 2/11/02 **Drawing A1.0**



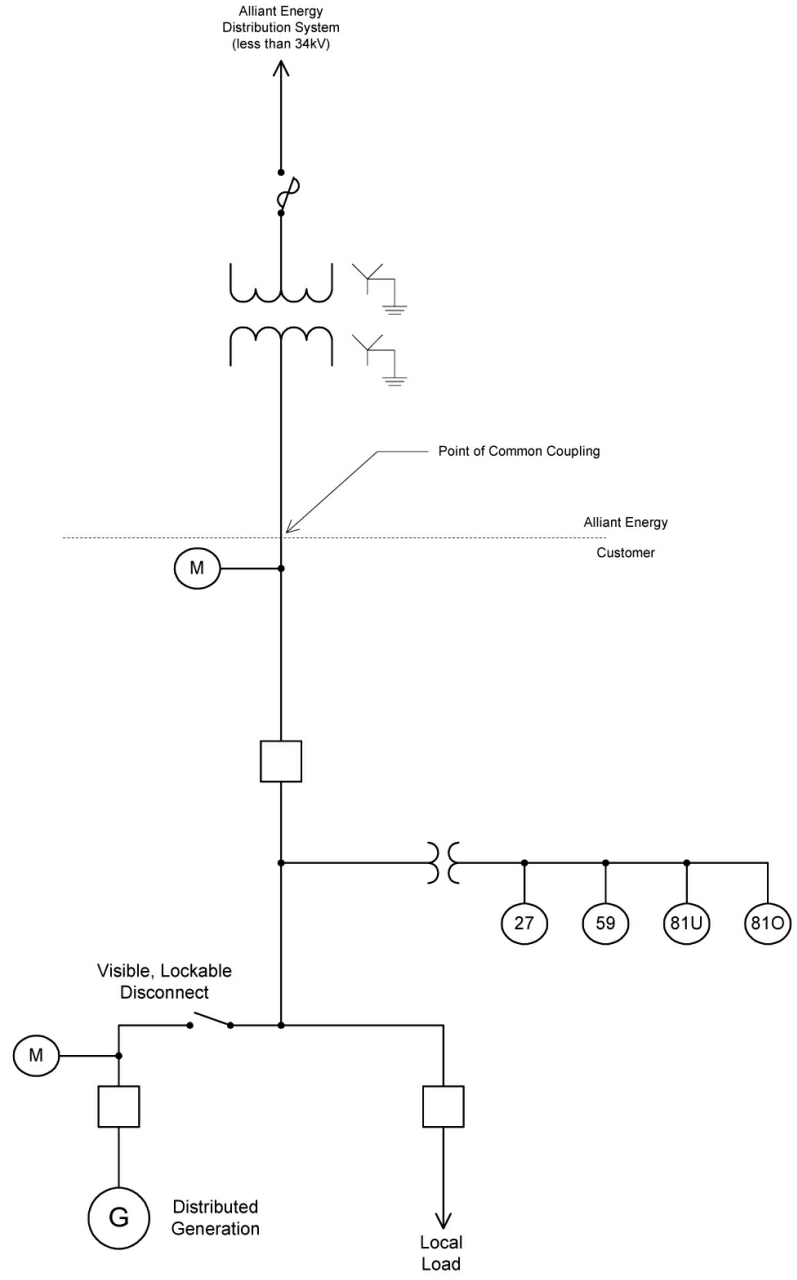
ALLIANT ENERGY.

Protection Requirements One-Line Diagram

Single Phase Induction Generators Less than 20 kW

Revised 2/9/02

Drawing A1.1



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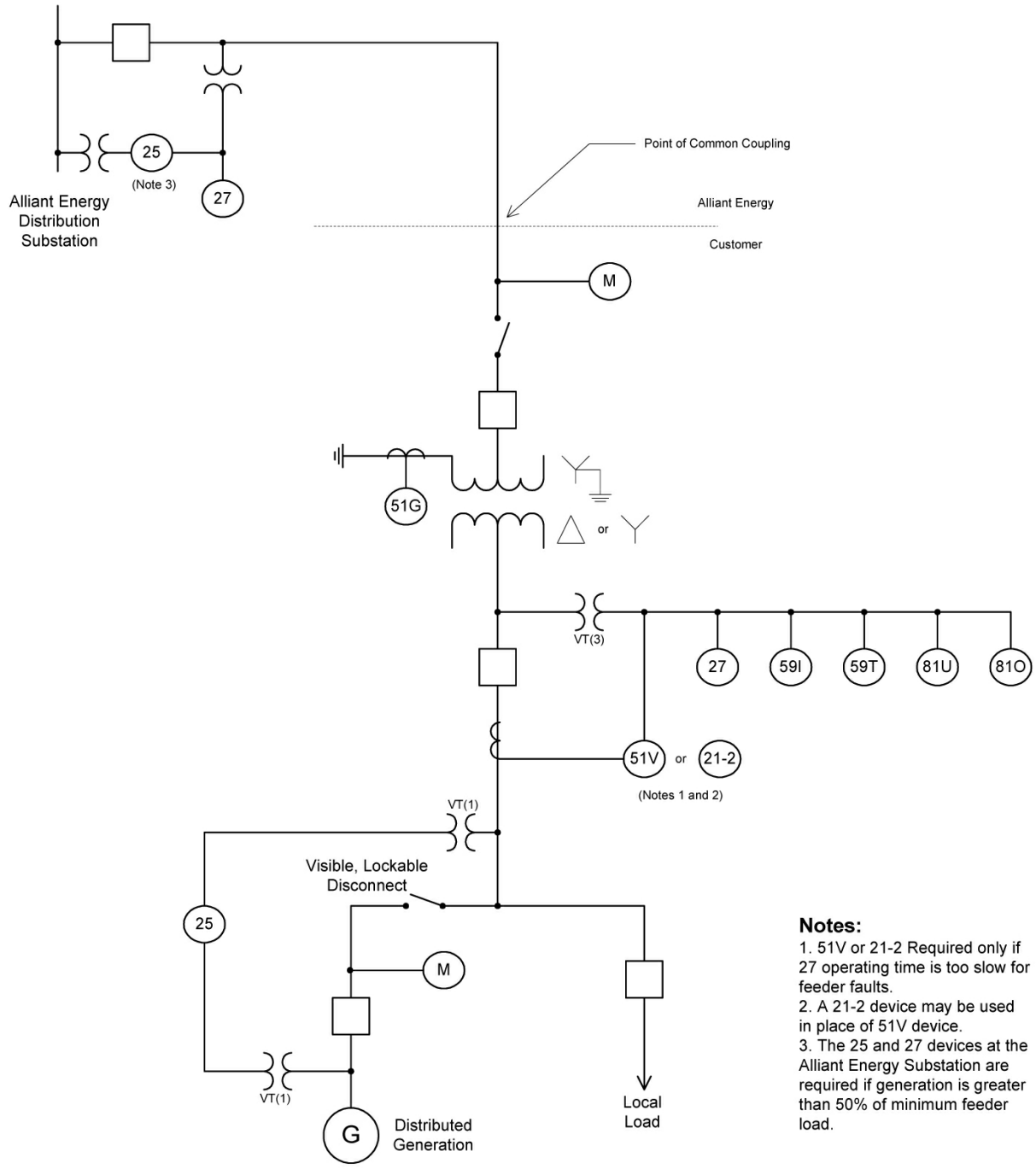
Protection Requirements One-Line Diagram

Synchronous and Induction Generators Larger than 20 kW and Smaller than 200 kW Connected Through a wye-wye Transformer

Revised 2/9/02

Drawing A1.2



Notes:

1. 51V or 21-2 Required only if 27 operating time is too slow for feeder faults.
2. A 21-2 device may be used in place of 51V device.
3. The 25 and 27 devices at the Alliant Energy Substation are required if generation is greater than 50% of minimum feeder load.

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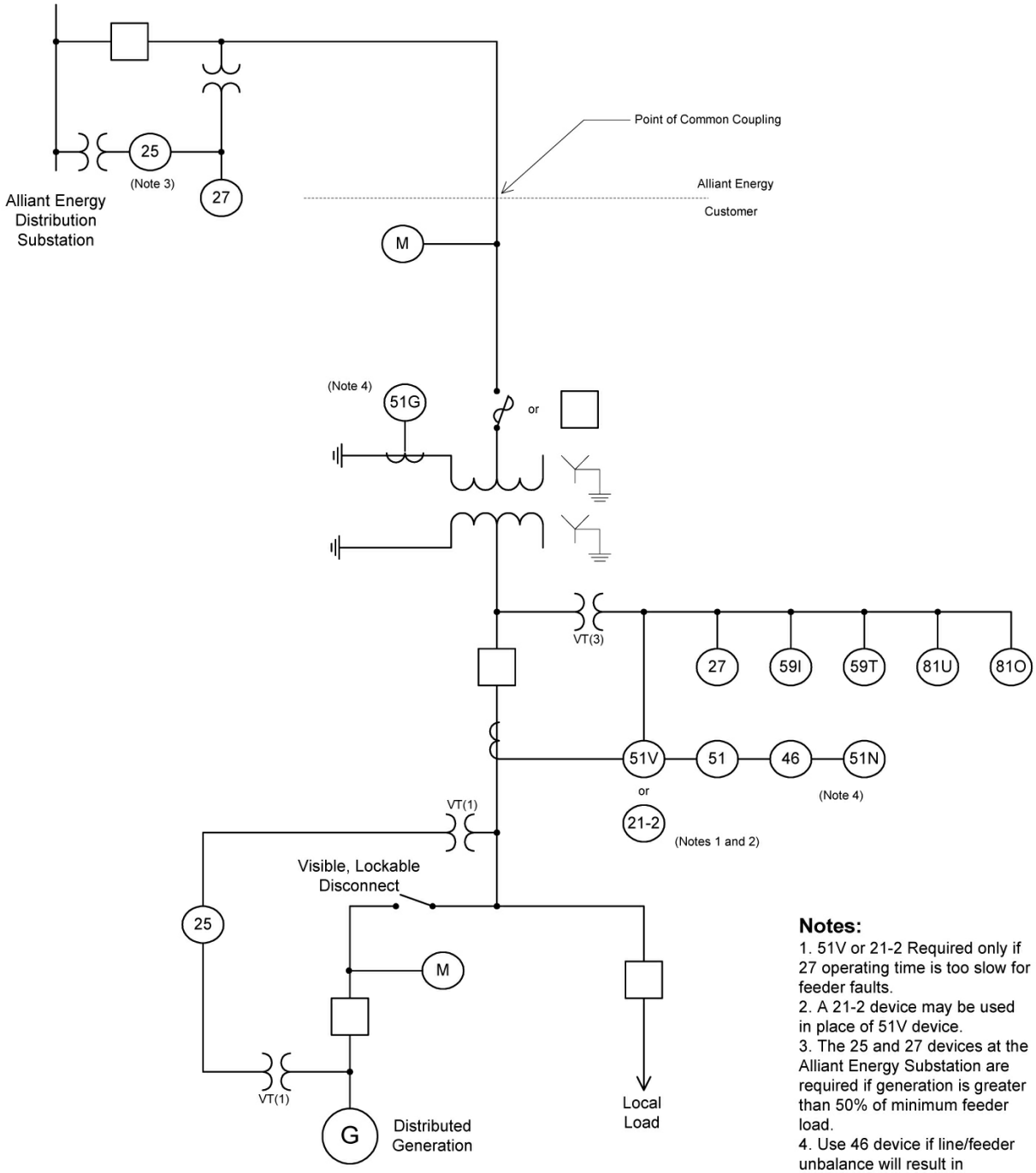
Protection Requirements One-Line Diagram

Synchronous and Induction Generators Larger than 200 kW Connected Through a grounded wye-delta (or ungrounded wye) Transformer

Revised 2/9/02

Drawing A1.3



Notes:

1. 51V or 21-2 Required only if 27 operating time is too slow for feeder faults.
2. A 21-2 device may be used in place of 51V device.
3. The 25 and 27 devices at the Alliant Energy Substation are required if generation is greater than 50% of minimum feeder load.
4. Use 46 device if line/feeder unbalance will result in transformer overload.

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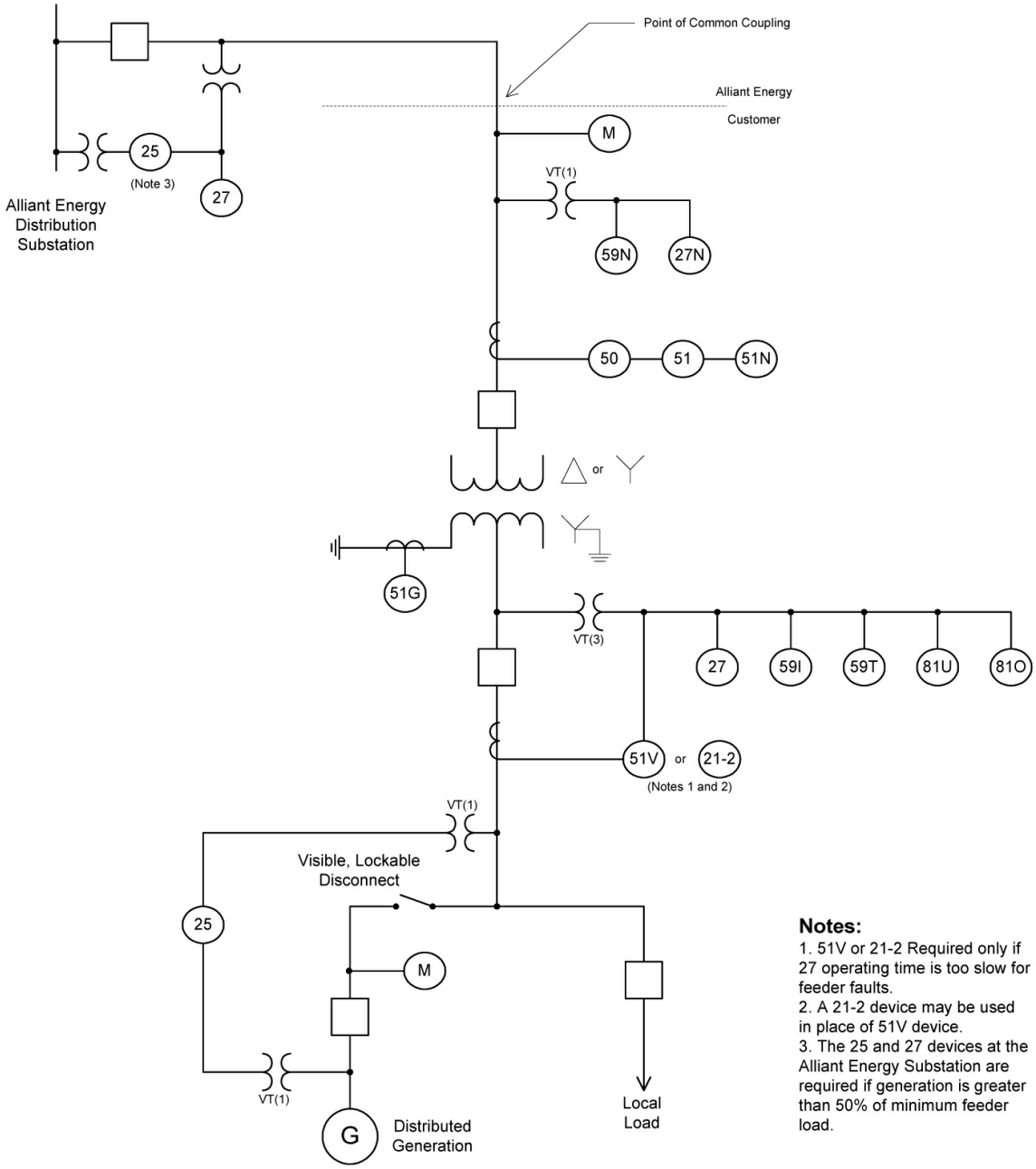
Protection Requirements One-Line Diagram

Synchronous and Induction Generators Larger than 200 kW Connected Through a grounded wye-grounded wye Transformer

Revised 2/9/02

Drawing A1.4



Notes:

1. 51V or 21-2 Required only if 27 operating time is too slow for feeder faults.
2. A 21-2 device may be used in place of 51V device.
3. The 25 and 27 devices at the Alliant Energy Substation are required if generation is greater than 50% of minimum feeder load.

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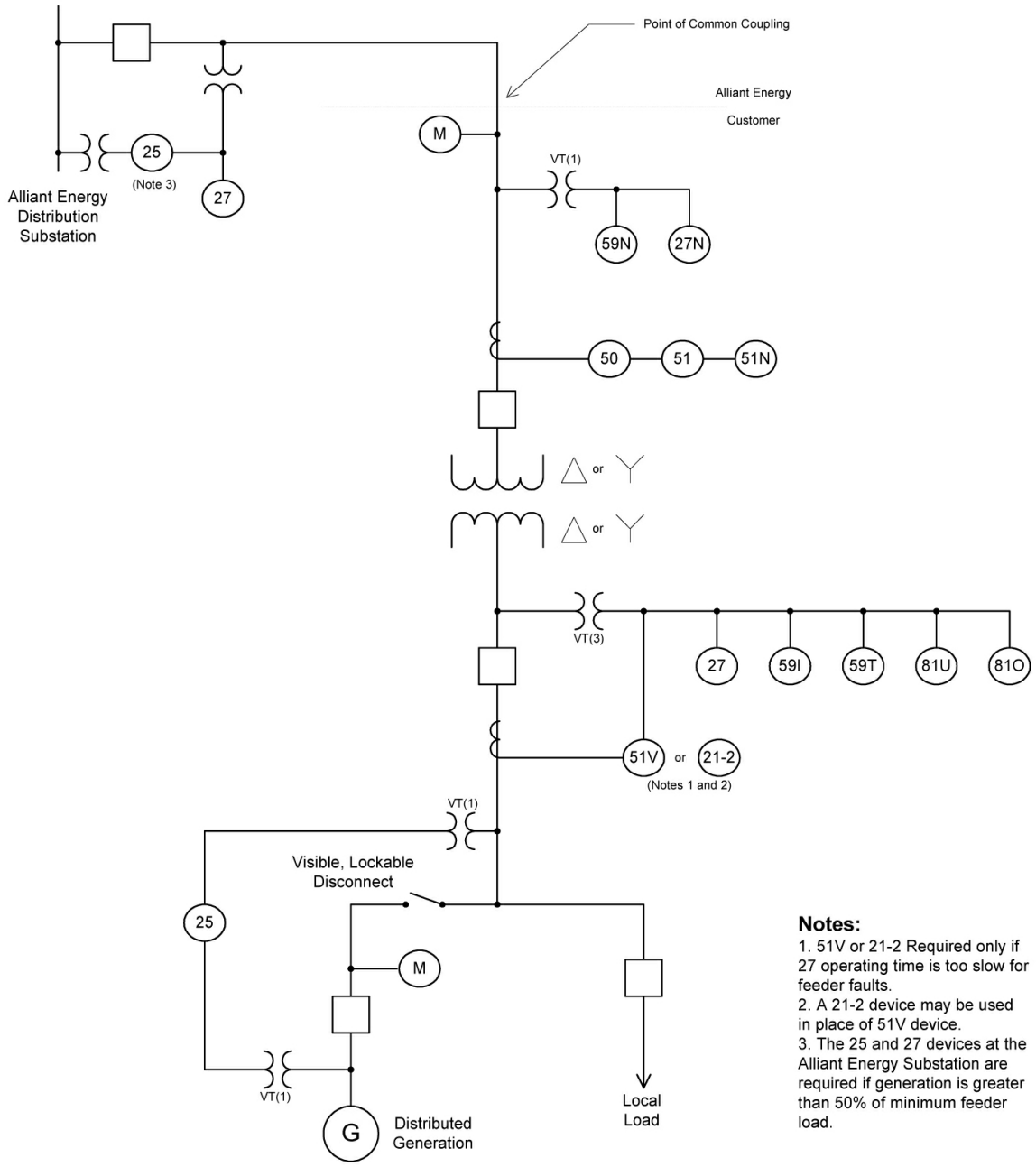
Protection Requirements One-Line Diagram

Synchronous and Induction Generators Larger than 200 kW Connected Through a delta (or ungrounded wye)-grounded wye Transformer

Revised 2/9/02

Drawing A1.5



Notes:

1. 51V or 21-2 Required only if 27 operating time is too slow for feeder faults.
2. A 21-2 device may be used in place of 51V device.
3. The 25 and 27 devices at the Alliant Energy Substation are required if generation is greater than 50% of minimum feeder load.

ALLIANT ENERGY

Protection Requirements One-Line Diagram

Synchronous and Induction Generators Larger than 200 kW Connected Through a delta (or ungrounded wye)-delta (or ungrounded wye) Transformer

Revised 2/9/02

Drawing A1.6

Additional Notes for each relay device:

Relay Device	Description, Purpose and Setting Parameters
21-2	Impedance relay (time-delayed). Provide tripping of the customer breaker for faults on Alliant Energy transmission or distribution line.
25	Synchronizing. Provide voltage and phase angle supervision of generator breaker closure.
27	Undervoltage. Provide tripping of the customer breaker should the Alliant Energy line voltage not be maintained within an acceptable lower limit. The relay should be capable of providing a trip time in the ½ to 2-second range. Actual voltage and time delay settings will be determined on a case-by-case basis.
27N	Neutral Undervoltage. Provide tripping of the customer breaker for ground faults on the Alliant Energy system. The relay should be capable of providing a trip time in the ½ to 2-second range. Actual voltage and time delay settings will be determined on a case-by-case basis.
46	Negative Sequence. Detects unbalanced conditions on feeders. Protects the interconnection transformer from overloads associated with unbalanced feeder loading.
50/51	Instantaneous/Time Overcurrent. Provide tripping of the customer breaker in the event of a phase fault on the customer system.
50/51N	Instantaneous/Time Ground Overcurrent. Provide tripping of the customer breaker in the event of a ground fault on the customer system and for close-in solid ground faults on the Alliant Energy feeder.
51G	Time Neutral Overcurrent. Provide tripping of the customer breaker for excessive Alliant Energy line unbalances or presence of a phase-to-ground fault.
51V	Torque-Controlled Time Overcurrent. Provide tripping of the customer breaker for faults on Alliant Energy transmission or distribution line.
59I	Instantaneous Overvoltage. Provide tripping of the customer breaker should the Alliant Energy line voltage not be maintained within an extreme acceptable upper limit. Actual voltage setting will be determined on a case-by-case basis.
59N	Neutral Overvoltage. Provide tripping of the customer breaker for ground faults on the Alliant Energy system. The relay should be capable of providing a trip time in the ½ to 2-second range. Actual voltage and time delay settings will be determined on a case-by-case basis.
59T	Time Overvoltage. Provide tripping of the customer breaker should the Alliant Energy line voltage not be maintained within an acceptable upper limit. The relay should be capable of providing a trip time in the ½ to 2-second range. Actual voltage and time delay settings will be determined on a case-by-case basis.
81O/U	Over/Under Frequency. Provide tripping of the customer breaker should system frequency not be maintained. This relay would be expected to operate if the customer should become isolated from the Alliant Energy system (islanding condition). The relay should be capable of providing a trip time in the ½ to 2-second range. Actual frequency and time delay settings will be determined on a case-by-case basis.

Alliant Energy has pre-approved a number of microprocessor relays that provide many of the necessary protective functions. Additional relays will be reviewed and approved on a case-by-case basis. The approved relays include:

- Beckwith M-3520
- Beckwith M-0296
- Beckwith M-0290 (single phase application)
- Schweitzer Engineering Labs SEL-321-1
- Schweitzer Engineering Labs SEL-351
- Schweitzer Engineering Labs SEL-251

Appendix 2

Parallel Operation with Alliant Energy

Generation Telemetry Requirements

Distributed Generation Greater than 1 MW and Less than 5 MW

This document refers to generator sites that have the following criteria:

1.) The aggregate generation output capability is greater than 1 MW and less than 5 MW connected to the Alliant Energy electric power system at a voltage less than 34 kV.
2.) The generator(s) may or may-not be involved in sales transactions through the Alliant Energy System. This document also refers to any generation less than 1 MW that is involved in wholesale power transactions.

For the reasons listed below, the Alliant Energy DDC (Distribution Dispatch Center) and GMS (Generation Management System) require continuous telemetry for certain data points & types:

1.) Determination and monitoring of real-time limit thresholds and/or violations. (Wholesale Transactions)
2.) Historical tracking of limit thresholds and/or violations. (Wholesale Transactions)
3.) Monitoring of Alliant Energy System Demand – Real-time and historical
4.) Monitoring of Reactance Flows - Real-time and historical
5.) Monitoring of Generator On or Off Line Status
6.) De-coupling of Generation and Load for Network Applications such as State Estimation and Security Analysis.

Depending on the physical site configuration, some data points require direct instantaneous telemetry, and others can be calculated on the basis of other telemetered points.

Required Data points:

Generation – *Aggregate or Individual Units, depending on size and configuration*

1.) Instantaneous - Generator Output (Mw) – Net if internal auxiliaries exist
2.) Instantaneous - Generator Output (Mvar) – Net if internal auxiliaries exist
3.) Hour End - Generator Output (Mwh Accumulated) – Net if internal auxiliaries exist
4.) Hour End - Generator Output (Mvarh Accumulated) – Net if internal auxiliaries exist
5.) Dedicated dial-up telephone communications to meter mass memory (MV90 Software) – Historical performance. (For Merchant generation).

Point(s) of Common Coupling with Alliant Energy

(May represents the Net of Customer Generation and Load)

1.) Interconnection Point (Mw) – Bi-Directional
2.) Interconnection Point (Mvar) – Bi-Directional
3.) Interconnection Point (Mwh Accumulated) – In and Out
4.) Interconnection Point (Mvarh Accumulated) – In and Out
5.) Dial-up telephone communications to meter (MV90 Software) – Revenue Billing

Some configurations may require “Total Load” (shown below) as an addition to, or a replacement of, the above “Point(s) of Service from Alliant Energy”

Total Load

1.) Total Load (Mw)
2.) Total Load (Mvar)
3.) Total Load (Mwh Accumulated)
4.) Total Load (Mvarh Accumulated)
5.) Dial-up telephone communications to meter (MV90 Software)

Status

1.) Status of all circuit breaker(s) that can disconnect a generator from the Alliant Energy System.
2.) Status of any bus tie circuit breakers

Total Load

1.) Total Load (Mw)
2.) Total Load (Mvar)
3.) Total Load (Mwh Accumulated)
4.) Total Load (Mvarh Accumulated)
5.) Dial-up telephone communications to meter (MV90 Software)

Reserve Auxiliary – Evaluate on a per project basis

1.) Reserve Auxiliary (Mw)
2.) Reserve Auxiliary (Mvar)
3.) Reserve Auxiliary (Mwh Accumulated)
4.) Reserve Auxiliary (Mvarh Accumulated)

Status

3.) Status of all circuit breaker(s) that can disconnect a generator from the Alliant Energy System.
4.) Status of any bus tie circuit breakers

Bus Measurement(s)

1.) One kV measurement per generator bus

Appendix 3

Generation Interconnection Request

Distribution Interconnection Forms

Overview
These forms are required for Interconnection of Distributed Generation to the Alliant Energy system. All customers wishing to install generation require the first form, "Distributed Generation Interconnection Request". This request, along with a detailed one-line diagram, should supply Alliant Energy with the necessary information for small (<20 kW) generators and pre-certified units. The second from, "Distributed Generation Request for Additional Information", may be required by customers with larger or more complicated installations. Alliant Energy will inform the customer when additional information is required.

Distributed Generation Interconnection Request
Provide contact information for the Owner, Design Engineer (if applicable) and Electrical Contractor. Also include the address of the proposed DG installation and the corresponding Alliant Energy account number (if available).

Alliant Energy also requests Generator Data as part of this request. This data is typically available from the generator manufacturer. Alliant Energy also requests the type of fuel (Energy Source) that will be used to power the generation. This could include, natural gas, wind, hydro, diesel, etc. This information is required to determine if the installation is a Qualifying Facility (QF) in accordance with the Public Utility Regulatory Policies Act (PURPA) of 1978. Qualifying Facilities may entitle the customer to different rates reserved for renewable resources.

Alliant Energy requests some basic technical information on this form. There is a list of pre-certified generators available on the Alliant Energy Distributed resources website, www.alliantenergy.com/xxxx, or a list may be obtained by contacting Alliant Energy at 1-(800) 972-5325. The remainder of the questions in this section pertain to whether or not the generator meets the requirements set forth in this document.

An estimate of the yearly load is required on this form. The information required is the estimated annual load at the site where the generation will be installed and the estimated yearly output, in kWh, of the generator. The customer may obtain the previous year's usage by contacting Alliant Energy at 1-800 Alliant, or the Account Manager (if applicable).

Finally, Alliant Energy requests a brief description of the facility along with a detailed one-line diagram showing the generation and the location of the visible disconnect.

Distributed Generation Request for Additional Information
This form may be required from customers installing larger or more complex DG installations. The information required on this form is technical data required for Alliant Energy to perform a more detailed engineering study of the installation. The customer may need a design engineer to complete this information.

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DISTRIBUTED GENERATION INTERCONNECTION REQUEST

INSTRUCTIONS:

1. This request is required for customers who are intending to install generation on its premises that will operate connected to the Alliant Energy Distribution System.
2. This request is intended to provide Alliant Energy personnel with information to determine requirements for interconnection of the customer's generation to the Alliant Energy System.
3. The request may be submitted electronically or mailed to the following address:

   Alliant Energy, Delivery System Planning G.O. 16, PO Box 351, Cedar Rapids, IA 52406-0351

   IA, MN, or IL Customers *(include $280.00 application fee)*

   Alliant Energy, Delivery System Planning 4902 N. Biltmore Lane, P.O. Box 77007, Madison, WI 53707-1007

   WI Customers *(see WI Tech Guideline for appropriate application fee)*

OWNER/APPLICANT INFORMATION

Company Name	Contact Name	
Phone No. ( )	Fax No. ( )	
Street Address	E-mail Address	
City	State	Zip

PROPOSED LOCATION OF GENERATOR UNIT

Street Address	Account No.	
City	State	Zip

DESIGN ENGINEER

Company Name	Contact Name	
Phone No. ( )	Fax No. ( )	
Street Address	E-mail Address	
City	State	Zip

ELECTRICAL CONTRACTOR

Contact Name	Phone No. ( )	Fax No. ( )
Street Address	E-mail Address	
City	State	Zip

GENERATOR DATA

Manufacturer		Model No.	Serial No.
Version No.	Type (Synchronous, Induction, Inverter, etc.)	Phase(s) ☐ 1 Phase ☐ 3 Phase	Total Number of Units Installed
Rated Output for One Unit (kW)	Rated Voltage (volts)	Rated Power Factor (%)	Energy Source

TECHNICAL REQUIREMENTS

Is This Generator Pre-Certified?	Which state(s) is the Unit Pre-Certified	Meets Power Quality Requirements?
☐ YES ☐ NO	☐ Iowa ☐ Illinois ☐ Michigan ☐ Wisconsin	☐ YES ☐ NO

Meets Control, Protection and Safety Requirements?	Performs to Relaying and Equipment Requirements?
☐ YES ☐ NO	☐ YES ☐ NO

ESTIMATED LOAD INFORMATION

Estimated Annual Consumption (without generation)	Estimated Annual Generator Production
kWh	kWh

ESTIMATED CONSTRUCTION DATES

Start Date	Completion Date

DESCRIPTION OF INSTALLATION

Attach a one-line diagram of the installation to this request form. The one-line diagram should show the specific location of the external disconnect. Provide a brief description of the generator operation, standby power, peak shaving.

Add brief description here:

Does the customer intend to:

- ☐ Sell power to Alliant Energy?
- ☐ Offset usage?
- ☐ Sell power to a third party over the Alliant Energy system?

Comments:

CUSTOMER SIGNOFF SECTION

Applicant Signature	Date

FOR ALLIANT ENERGY USE ONLY

Date Received	DR Request No.
Date Into DR DB	Assigned Planner

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Distributed Generation Request for Additional Information

1. This form is required to provide additional information to Alliant Energy personnel for completion of an Interconnection Study.
2. In addition to the information required on this form Alliant Energy requests a detailed one-line diagram of the proposed facility.
3. Complete this form for **each** proposed generator that will be installed on-site.

Name:		DR Request #:	

(Complete all applicable items, Copy this page as required for additional generators)

Synchronous Generator Data (If applicable)

Unit Number:		Total number of units with listed specifications on site:					
Manufacturer:							
Type:		Date of manufacture:					
Serial Number (each)							
Phases: 1 or 3		Speed (RPM):				Frequency (Hz):	
Rated Output		kW		kVA			
Rated Power Factor (%):		Rated Voltage(Volts):				Rated Current (Amperes):	
Field Voltage (Volts):		Field Current (Amps):				Motoring Power (kW):	
Synchronous Reactance (X_d):			% on				kVA base
Transient Reactance (X'_d):			% on				kVA base
Subtransient Reactance (X''_d):			% on				kVA base
Negative Sequence Reactance (X_s):			% on				kVA base
Zero Sequence Reactance (X_o):			% on				kVA base
Neutral Grounding Resistor (if applicable):							
I^2t or K (heating time constant):							
Exciter data:							
Governor data:							

Additional Information:

Induction Generator Data (If applicable)

Rotor Resistance (R_r):		Ohms	Stator Resistance (R_s):		Ohms
Rotor Reactance (X_r):		Ohms	Stator Reactance (X_s):		Ohms
Magnetizing Reactance (X_m): Ohms		Ohms	Short Circuit Reactance (X_d''):		Ohms
Design Letter:			Frame Size:		
Exciting Current:			Temp Rise (deg C°):		
Rated Output (kW):					
Reactive Power Required:		kVars (no Load)			kVars (full Load)

If this is a wound-rotor machine, describe any external equipment to be connected (resistor, rheostat, power converter, etc.) to rotor circuit, and circuit configuration. Describe ability, if any, to adjust generator reactive output to provide power system voltage regulation.

Additional Information:

Prime Mover (Complete all applicable items)

Unit Number:		Type:				
Manufacturer:						
Serial Number:				Date of Manufacture:		
H.P. Rated:		H.P. Max:		Inertia Constant:		lb.-sq. ft.
Energy Source (hydro, steam, wind, etc.):						

Inverter Data (If applicable)												
Manufacturer:							Model #:					
Rated Power Factor (%):				Rated Voltage (Volts):					Rated Current (Amps):			
Inverter Type (ferroresonant, step, pulse-width modulation, etc.):												
Type of Commutation (forced or line):							Minimum Short Circuit Ratio required:					
Minimum voltage for successful commutation:												
Current Harmonic Distortion Maximum Individual Harmonic (%):												
Maximum Total Harmonic Distortion (%):												
Voltage Harmonic Distortion Maximum Individual Harmonic (%):												
Maximum Total Harmonic Distortion (%):												
Describe capability, if any, to adjust reactive output to provide voltage regulation:												
NOTE: *Attach all available calculations, test reports, and oscillographic prints showing inverter output voltage and current waveforms.*												

Type of Interconnected operation	
Open Transition	
Closed transition	
Long term Parallel operation	

Transformer (If applicable)												
Manufacturer:							Date of Manufacture:					
kVA Rating:						Serial Number:						
High Voltage:		kV	Connection (delta or wye):					Neutral solidly grounded?				
Low Voltage:		kV	Connection (delta or wye):					Neutral solidly grounded?				
Transformer Impedance (Z):				% on								kVA base
Transformer Resistance (R):				% on								kVA base
Transformer Reactance (X):				% on								kVA base
Neutral Grounding Resistor (if applicable)												

Power Circuit Breaker (If applicable)												
Manufacturer:				Model:								
Rated Voltage (kilovolts):				Rated Ampacity (Amps):								
Interrupting Rating (Amps):				BIL Rating:								
Interrupting Medium (vacuum, oil, gas, etc.):						Insulating Medium (vacuum, oil, gas, etc.):						
Control Voltage (Closing):		Volts	AC or DC?									
Control Voltage (Tripping):		Volts	AC or DC?				Battery or Charged Capacitor?					
Close Energy (Spring, Motor, Hydraulic, Pneumatic or Other):												
Trip Energy (Spring, Motor, Hydraulic, Pneumatic or Other):												
Bushing Current Transformers (Max. ratio):							Relay Accuracy Class:					
Multi Ratio?												
Construction Schedule:	Start date:					Completion date:						

Customer Sign Off Area			
Applicant Signature:		Date:	

For Alliant Energy Use Only	
Date Received:	Date Entered into DB: